Benefits of Southern Company Transport Gasifier Project

Clean Coal Power Initiative

- Round 2 -

Demonstration of Air-blown Integrated Gasification Combined Cycle (IGCC) Power Plant with Coal-based Transport Gasifier

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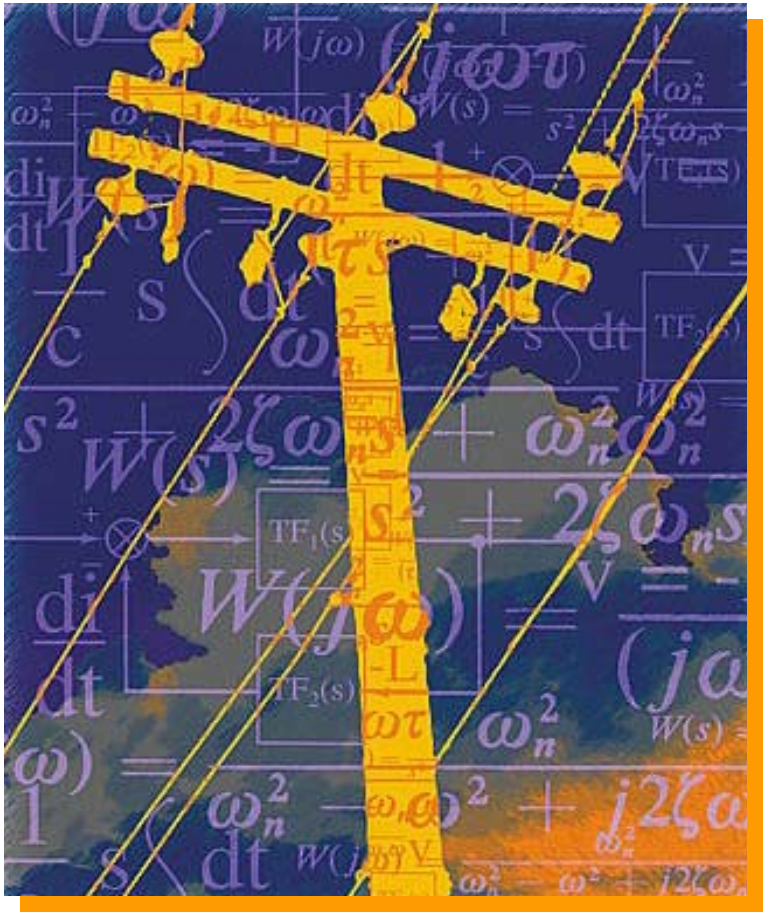


Executive Summary

- Demonstration Projects are critical to successful commercialization of technology developed under the U.S. DOE Fossil Energy Program
- The Clean Coal Power Initiative (CCPI) is an important U.S DOE Demonstration Program
- Project partners will design, construct, and operate a coal-based transport gasifier as part of an Air-blown IGCC power plant under CCPI, Round 2

Southern Company Services
Project Basics

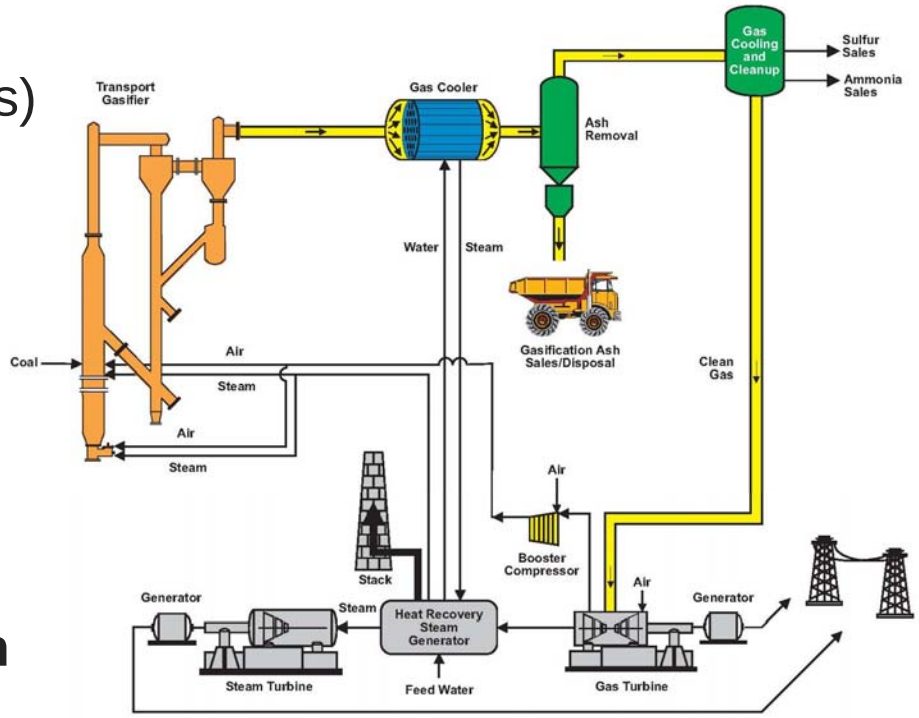
- **A full-scale demonstration of a highly efficient, fuel flexible, coal-based, air blown transport gasifier in an IGCC power plant**
- **3,300 tons of sub-bituminous coal per day producing 285 MW of electricity**
- **Project Cost: $557 million (DOE share: $235 million)**
- **Location: Stanton Energy Center, Orange County, FL**
- **Schedule:**
  - 2005 Project Start
  - 2007 to 2009 Construction
  - 2010 to 2014 Operation

Team Composition

- **Southern Company Services, Inc., Birmingham, AL**
  - Project & Technology Management
- **Southern Power Company, Birmingham, AL**
  - Co-owner
- **Orlando Utilities Commission (Orlando, FL)**
  - Co-owner
- **Kellogg Brown and Root (Houston, TX)**
  - Technology Partner

IGCC System Basics

- **IGCC plants use two power cycles, generating electricity more efficiently**
  - Coal is heated in a specialized process to release gas (syngas)
  - Syngas is used in a turbine to generate electricity
  - Then exhaust gas from the turbine is used to heat water, which produces steam to generate additional electricity
- **Therefore, the amount of electricity generated from a ton of coal is increased**



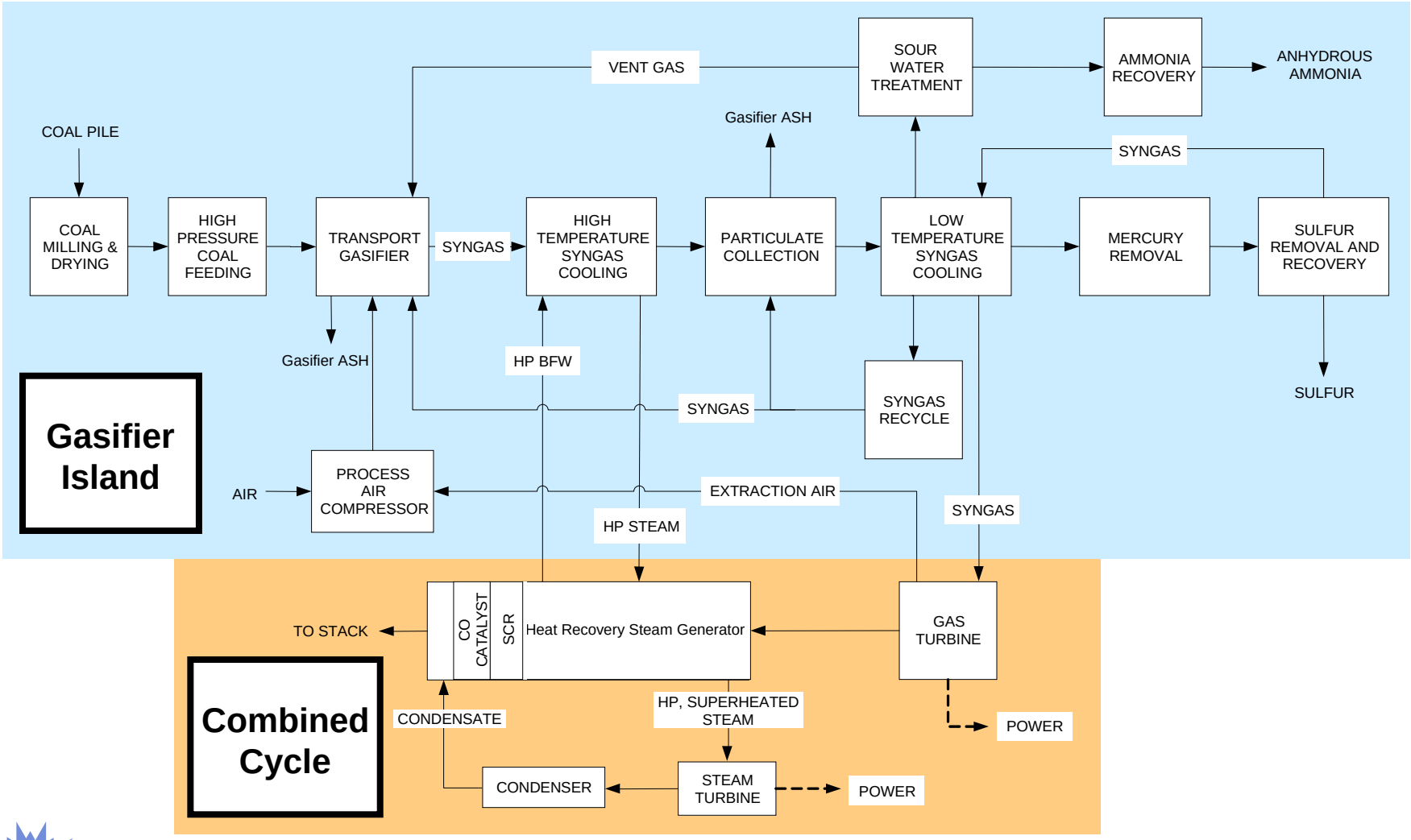
Oxygen versus Air-Blown IGCC Systems

- **Coal gas is produced with oxygen in some IGCC plants**
- **Oxygen plants:**
  - are expensive to build
  - require high levels of electricity to operate
  - reduce electricity available for sale to consumers
- **Southern Company's Air-Blown IGCC system uses oxygen from the air to produce coal gas, increasing the overall efficiency of the plant**
  - Process does not require a costly oxygen plant

Transport Gasifiers

- **Fluid Catalytic Cracker (FCC) technology, which is the basis for Transport Gasifiers, has a long track record, being used for more than 50 years in the petroleum refining industry**
- **Southern Company's Transport Gasifier, based on Kellogg Brown and Root's FCC technology, is:**
  - fuel-flexible
  - unique because it can cost-effectively process low rank coals and coals with high moisture or high ash content
  - adaptable to other applications beyond power generation, such as chemical production
  - efficient (40.6%), operating at a heat rate of 8,400 Btu/kWh

Orlando Utilities Commission/Southern Company Services IGCC Summary Flow Diagram



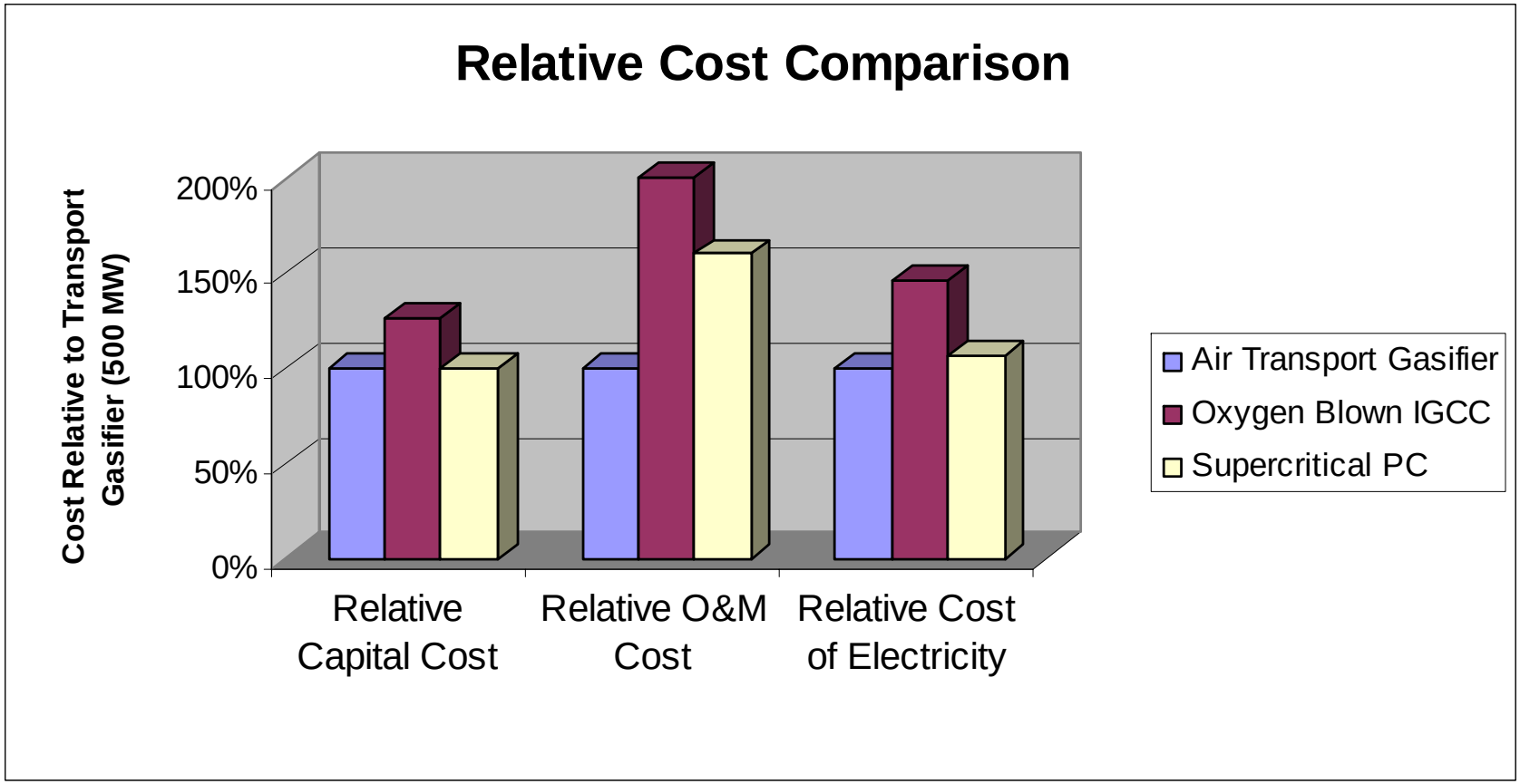
Estimated Benefits
Approach

- **Compare the IGCC Plant emission performance against standards for Clean Coal Technology Roadmap plant in 2020**
- **Compare scaled-up 500 MW Transport Gasifier Plant (more efficient than demonstration plant) to emission rates and capital and operating costs to those of other coal-based technologies of equal size**

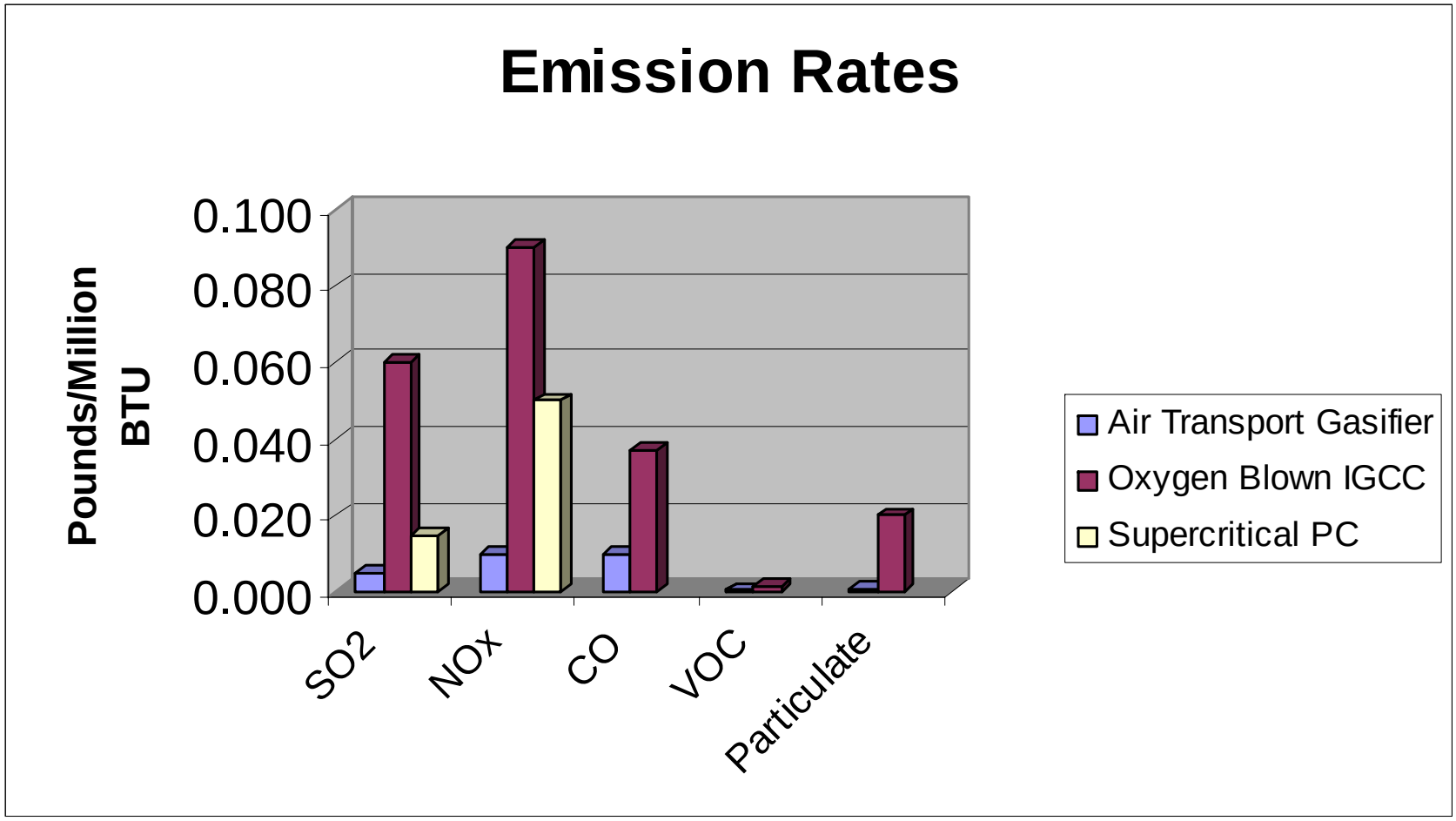
Estimated Benefits
Comparison Assumptions

- **Benefits comparisons are based on the following plant configurations for a sub-bituminous coal:**
  - Oxygen-blown IGCC plant based on two gasifiers, two GE 7FA gas turbines, full heat recovery, methyldiethanolamine (MDEA) sulfur removal and 1,615 psia /1,000ºF/1,000ºF steam conditions
  - Supercritical PC plant with SCR & spray dryer absorption (SDA) 97% sulfur capture and 3,515 psia / 1,050ºF/1,050ºF steam conditions
  - Transport Gasifier plant based on two gasifiers, two GE 7FA gas turbines, CrystaSulf sulfur removal and 1,815 psia/1,000ºF/1,000ºF steam conditions

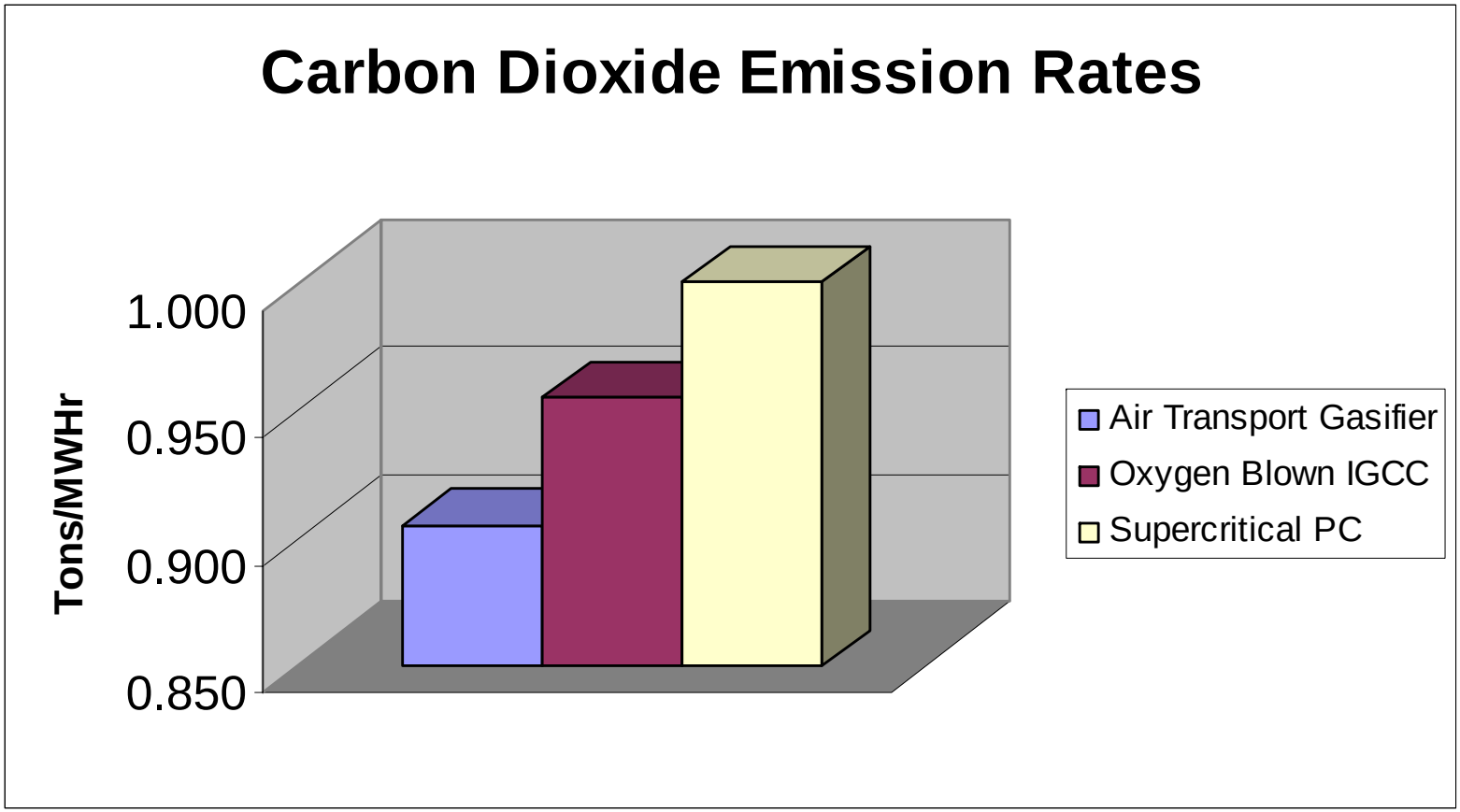
Estimated Benefits
Financial



Estimated Benefits
Emissions

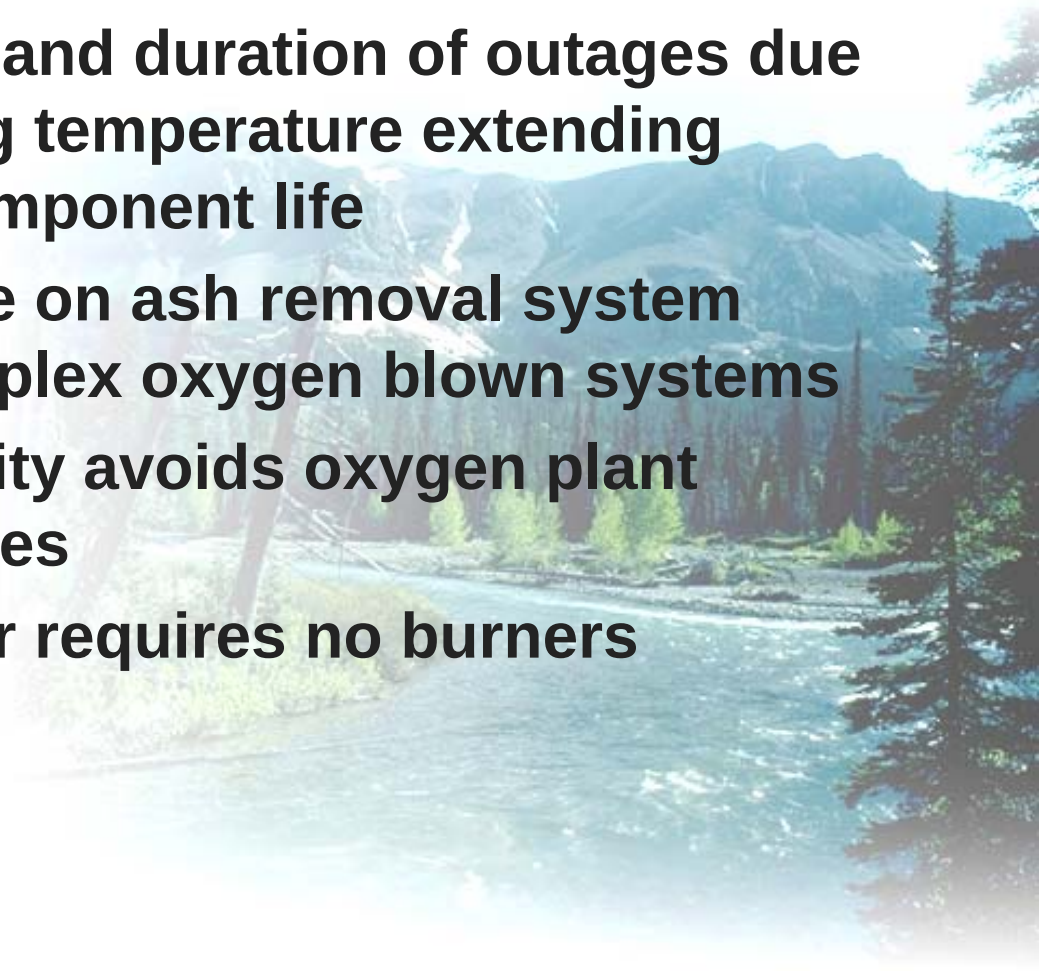


Estimated Benefits
CO_2 Emission



Estimated Benefits
Reliability and Availability

- Reduced number and duration of outages due to lower operating temperature extending refractory and component life
- Less maintenance on ash removal system than in more complex oxygen blown systems
- Air blown capability avoids oxygen plant maintenance issues
- Transport Gasifier requires no burners



Estimated Benefits
Combustion Utilization Byproduct

- **All recovered sulfur marketable locally**
- **Gasifier ash tested and designated non-hazardous**
  - Potential applications identified
  - Remaining ash can be land filled on-site
- **Anhydrous ammonia recovered from process water**
  - Utilized in demonstration SCR unit
  - Remainder consumed by units at the Stanton Energy Center or sold

Estimated Benefits
Regional

- **Plant construction will create an estimated 1,800 jobs in Orange County, FL**
- **Reduced water consumption is incorporated into plant design**
- **On-site research projects, in partnership with the Florida Energy Office, can potentially expand the use of “next generation” hydrogen technology for fuel cells or vehicles**

Estimated Benefits
National

- **Air-blown systems will be:**
  - one of the cleanest, simplest, and most robust methods for generating power from coal
  - more energy and cost efficient than currently available oxygen-blown entrained-flow gasifiers
  - fuel flexible, processing low rank coals and coals with high moisture or high ash content (half the proven reserves in U.S.)
  - able to meet high environmental standards for SO_2, NO_x, particulate, and mercury emissions
  - adaptable to other applications, such as chemical production
  - adaptable for carbon capture and sequestration technologies

National Benefits (continued)

- **Beneficial uses for gasifier ash have been identified**
- **The technology increases energy security by utilizing the Nation's sub-bituminous coal reserves**
- **Furthers environmental initiatives for America:**
  - Clear Skies
  - Global Climate Change
  - FutureGen
  - Hydrogen

Conclusion

- **Significant emissions and energy security benefits will result from the successful demonstration and commercialization of the Southern Company Services, Inc. Transport Gasifier and other technologies developed under the Clean Coal Power Initiative**

Visit the NETL web site for information on all Power Plant Improvement Initiatives and Clean Coal Power Initiative projects

www.netl.doe.gov/coal/CCPI